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Foresight on Information Society Technologies in Europe

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1 Introduction

This article provides an overview of a recently completed European foresight study on information society technologies. FISTERA (Foresight on Information Society Technologies in the European Research Area) was implemented as part of the action plans called "eEurope 2002" and "eEurope 2005," which are pillars of the European Commission's policy.

Europe aims to build a "competitive knowledge-based economy" as stated in the Lisbon Objective, an agenda described below, by means of information society technologies (ISTs). In order to define future visions of ISTs, FISTERA was launched under the leadership of the Institute for Prospective Technology Studies (IPTS), a joint research institute of the European Commission.

In this foresight study, ISTs are clearly distinguished from ICTs, or information communication technologies. While ICTs naturally constitute the major part of the target of the study, the concept of ISTs does not only consist of ICTs and changes therein. Compared with ICTs, which are related to production, information processing and industry, ISTs require discussion on adoption and application of technologies in society. FISTERA set out to consider the ideal form of the information society, taking into account trends in each technology field.

FISTERA started by reviewing earlier national-level foresight exercises in European Union member states. Then, it analyzed patent data to examine technological competitiveness, conducted Delphi studies on social transition, and constructed scenarios on future ambient environments. A wide range of issues, including human resources development, were discussed. Launched in September 2002, the project was finalized at the international conference held in Seville, Spain, in June 2005, toward the end of the study's three-year schedule. Results of project activities, such as reports on specialist workshops, summaries of analysis results and trends in ICT fields identified through surveys, are being published on the official Web site (http://fistera.jrc.es/) as they become available. The project has cost approximately 1.5 million euros.

This article introduces key findings from the summary report of FISTERA in order to outline the future of ISTs as envisioned by European experts.

2 Background and goal of FISTERA

2-1 The Lisbon Objective

The European science and technology policy addresses ICTs as an element of ISTs and treats ICTs in connection with system development technologies in interdisciplinary and application areas under a broader and more structured concept. The foundation for such pan-European technology policies is the Lisbon Objective, which is described below.

In March 2000, leaders of the EU member states gathered in Lisbon and set a strategic policy goal called the Lisbon Objective. This declared that by 2010 the EU should become "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable growth with more and better jobs and greater social cohesion." The EU leaders also agreed that, as a policy goal for the next 10 years, they would seek to enrich the EU and to narrow remaining regional disparities between European nations by carrying out measures to fulfill the above goal. They placed special emphasis on technological innovation in the ICT sector and vitalization of related markets as keys to achieving full employment and strengthening corporate competitiveness.

2-2 FISTERA's goal

FISTERA is a large-scale technological foresight study that was designed to benchmark current ISTs and develop strategies for future ISTs in order to realize the goal stated in the Lisbon Objective.

The study was aimed at bringing together the knowledge of European IST experts. First, it compared results of national foresight exercises in Europe. Then, the project proceeded using a network of existing research institutes across Europe. For example, PREST (Policy Research in Engineering, Science and Technology), a British research organization, undertook implementation of Delphi studies and scenario-building. Participating research institutes were assigned sub-projects, and they prepared individual reports that were integrated into a summary report under the leadership of IPTS.

While there have been a number of technological foresight exercises conducted in individual European nations, many of these have lacked a "pan-European" perspective. FISTERA emphasized this pan-European perspective and was designed to collate knowledge that could contribute to promotion of the European Research Area (ERA) and to construct a network of experts.

Results of FISTERA studies have been summarized by constructing and discussing "Technology Trajectories" (described below) from a pan-European perspective. As an outcome of the FISTERA project, a knowledge base on the future visions of ISTs has been constructed in order to provide a bird's-eye view of the future. Another outcome is deepened mutual understanding among experts in ISTs through the process of project studies, based on which a forum on ISTs was organized to enable research results to be shared.

3 Overview of FISTERA

A large number of reports have already been released from the FISTERA project, including a summary of the discussion on human resource issues and the results of online Delphi studies [4]. To describe the outcomes of FISTERA, this chapter focuses on Reference 1 "Key Factors Driving the Future Information Society in the European Research Area, Synthesis Report on the FISTERA Thematic Network Study (Sep 2002-Sep 2004)," which has been published as a summary report on the entire project.

3-1 Structure of the summary report

Table 1 shows the structure of Reference 1, a document that outlines the FISTERA project.

Table 1 : Contents of the summary report

Key Factors Driving the Future Information Society in the European Research Area — Synthesis Report on the FISTERA Thematic Network Study—	
Executive Summary	
Introduction	
1. Methodology	Analyzing by factors; Combining top-down and bottom-up approaches
2. Social Drivers and Challenges	Changing social relationships; Leisure and recreation; Aging population; Health, Cultural diversity and migration; Transport and mobility; Learning and education; Social welfare; Public services; Government; Security
3. The Human Factor	Skills shortages and skills mismatch; Lifelong learning; Accessing potential labor reserves; Brain drain; Skills outsourcing
4. The Political Environment	Europe's current IST capacity; European Union goals; Foresight studies in EU member states; Commission programs; Member states' activities
5. Technological Drivers	Technology trajectories; Perception of European position; National foresight on technology applications; Technology disruptions

Source: Prepared by STFC based on Reference [1]

Table 2 : Competitiveness (SWOT) analysis tools

	Europe's strengths and weaknesses	Opportunities, threats, and challenges
Technology-related factors	Bibliometric analysis of patents, publications and secondary sources (such as R&D funding), national foresight studies	Analysis of Technology Trajectories and disruptions, assessments included in national foresight studies
Economic and political factors	Information from national foresights and literature	Online Delphi and targeted workshops, information from national foresights and literature
Socio-related factors	Information gathering from literature search and online-Delphi	Scenario-building exercises and workshops, and online-Delphi
S&T-based competitiveness	Interviews, online-Delphi, information gathering through research and analysis	Scenario-building exercises and workshops

SWOT: Analysis of Strength, Weakness, Opportunity and Threat

Source: Prepared by STFC based on Reference [2]

Chapter 1 of the report describes approaches to the foresight studies and the relationships between sub-projects assigned to partner organizations. Chapter 2 explains the scope of ISTs as divided into about 10 categories. In this chapter, ISTs are distinguished from ICTs in respect of being oriented toward social application. Chapter 3 addresses human resources required for technological progress from the viewpoint of pan-European science and technology policies. Chapter 4 assesses Europe's current IST environment and discusses how this foresight project is related to the European Commission's science and technology policy programs. Chapter 5, focusing on elements of ISTs, considers future technological trends, and derives factors necessary for achieving ISTs from these trends.

3-2 Analyzing competitiveness

The FISTERA study started by reviewing the results of national foresight studies from several EU member states. Whereas these studies present results that are beneficial at the national level, FISTERA reconsidered them from the perspective of contribution to the prosperity of Europe as a whole. To do this, FISTERA analyzed the strengths and weaknesses of Europe based on patent statistics, conducted Delphi and other questionnaire surveys of experts, hosted workshops of experts, and developed roadmaps and scenarios. A novel development was online utilization of these well-established foresight tools.

Table 2 summarizes all the tools that FISTERA used for analyzing the technological, economic and political, and social factors as well as science and technology-based competitiveness.

To assess Europe's position relative to the U.S. and Japan, FISTERA carried out bibliometric analysis of patent data. For example, Reference 2 shows the results of bibliometric analysis of the patents filed between 1976 and 2002 in selected fields. The source data consist of the number of patents filed in Japan, the U.S. and Europe, as well as other patent-related statistics. The results indicate that Europe generally lags behind the U.S. and Japan, whereas Europe excels in certain technologies such as trunking in the communications field. FISTERA also reveals that most European patents are held by large companies, suggesting a need to promote ISTs among small- to medium-sized businesses.

In addition, Europe's strengths and weaknesses in about 90 key technologies in the information and communications field were analyzed by specialists in the respective areas. To do this, a database of technological trends was built and offered to specialists, and their opinions were sought. Table 3 shows some of the key technologies in which specialists determined Europe has strengths.

FISTERA defines these technologies as basic elements of "Technology Trajectories" and assumes clusters of these technologies offering functions that contribute to the progress of an information society in given ambient environments. Technology Trajectories and technology clusters are discussed in more detail, below.

Analysis of the selected technologies showed that Europe generally lags behind the U.S. and Japan. FISTERA also notes that the gap between the EU and its key competitors has not

Table 3 : Technologies in which Europe is competitive

Technologies	Leading countries
3D scanner	U.S., Japan / Europe (Italy)
Batteries	U.S., Japan, Korea / Europe (Italy, Germany)
Cell phones	Europe (Finland, Germany, France, Netherlands, Sweden)
e-book reader	U.S., Japan / Europe (Netherlands)
e-ink	U.S., Japan / Europe (Netherlands)
Galileo (satellite-based positioning)	Europe
Mobile processing	Europe (Finland, Germany, France), Japan, U.S.
MPEG	Europe (Italy, Germany, Netherlands)
Printer	Japan, Korea / Europe (Italy)
Radio connectivity	Europe
Trunk	Europe (France, Germany)
Voice synthesis-recognition	U.S., Europe

The technologies in which Europe is leading have been extracted from about 90 technologies listed.
Source: Prepared by STFC based on Reference [2]

diminished since the Lisbon Objective was set in 2000. At the same time, the study suggests that Europe has maintained its leadership in a number of technologies in which it has been traditionally strong, such as communications technology.

3-3 Human resources issues

Human resources issues were discussed extensively in FISTERA workshops [3].

FISTERA mentions that temporary shortages of skilled labor in the information and communications sector in the latter half of 1990s have been mitigated since 2001 due to the bursting of the IT bubble, worldwide. However, the study indicates that, since this mitigation has been brought about primarily by market restructuring, the labor market in the ICT sector will face different types of shortages from those it experienced before the collapse of the bubble.

FISTERA forecasts that the primary change in demand for human resources will be a shift from very specialized technological expertise to broader skills. Firms increasingly seek personnel who combine technical expertise with an understanding of the IST market, business acumen in identifying which products have market potential, and customer-relations skills. The secondary development will be higher demand for people with the ability to acquire new skills in line with changing business operations and the changing role of companies. As to retraining of the existing workforce, FISTERA stresses lifelong learning, which can help reduce skills mismatch. It also emphasizes the growing importance of changing the quality of employment to offer new opportunities for those who hitherto have been undervalued, including women, immigrants and ethnic minorities.

The EU can be characterized by its relationships with surrounding countries, including those that are candidates for membership of the enlarged Union (e.g. East European countries, Turkey), and a close relationship with India, whose former colonial ruler is the U.K. These are essential factors in considering the outsourcing of labor and software development. With regard to outsourcing, while stressing the relationships with India and China, FISTERA draws attention to the emergence of East European countries and suggests the potential benefits to Germany.

3-4 Summary of the foresight study

In conclusion, Reference 1 suggests that investment in research and development needs to be increased in order to realize the Lisbon Objective. According to statistics for 2001, EU investment in IST R&D accounts for almost 2% of GDP, and the average growth rate for 1997-2002 is only 4%. To meet the Lisbon target of “3% of GDP by 2010,” an increase in overall R&D expenditure of 8% a year is required, up to 2010.

Particularly in the IST sector, disruptive technologies, or unpredictable extensions of current technologies, may emerge. FISTERA cites examples of areas where such technology disruptions can occur. The study states that if a technology disruption occurs suddenly, it should be given prompt and constant support.

On June 16 and 17, 2005, the conference to finalize the FISTERA project was held in Seville, Spain. The conference theme was "IST at the Service of a Changing Europe by 2020."

It should be noted that FISTERA not only targets 2010, by which date the Lisbon Objective should be realized, but also projects as far ahead as 2020 in discussing future Technology Trajectories and scenarios. Based on experts' opinions, the project also considers setting 2020 as the target year for achieving IST-related goals.

4 Trends in information society technologies

This chapter describes the trends in ISTs as discussed in FISTERA[1], first clarifying application areas for ISTs, and then looking at the concept of "Technology Trajectories." Ten Technology Trajectories were selected for the study. Trends in each of these Technology Trajectories, as identified by FISTERA based on experts' opinions, are shown below. Consequently, FISTERA names the areas whose future trends are worthy of attention as "technology disruptions." In addition, a Web site that provides technology trends identified through the foresight study is mentioned later in this chapter.

4-1 *Application areas for ISTs*

Application areas for ISTs are expected to expand, especially around healthcare, education, transport and governmental services. FISTERA's summary report discusses, for each of these application areas, which functions will be provided by future technologies in the information and communications sector, and how these functions will benefit individual areas.

For example, given European demographics, healthcare and applications for older people are increasingly high on the political agenda. Health insurance and healthcare systems in many EU member states are faced with cost problems, which ISTs can ease by improving efficiency. FISTERA suggests that ISTs should offer solutions to such challenges. FISTERA also notes the merging of previously separated spheres of daily life, such as work and leisure, and leisure and learning, with the emergence of new concepts such as "infotainment" at the interface between information and entertainment. With respect to the success of teleworking, the report points out that favorable conditions for this style of working are finally emerging on a large scale in this era of increasing economic globalization.

4-2 *Technology Trajectories concept*

FISTERA uses the concept known as Technology Trajectory (TT) in analyzing future visions for ISTs.

To develop this concept, FISTERA first focuses on the functionality of a technology. For example, when one refers to semiconductor chip technology, there remains ambiguity as to whether this represents a single technology or a group of technologies with dissimilar natures, such as etching, lithography and logic. In other words, whenever the term "technology" is used, it is difficult to define precisely what it means. To avoid this ambiguity in defining technology, FISTERA focuses attention on the "functionality" of technology. By forming clusters of technologies, FISTERA considers what functions each cluster can deliver and what kind of service and ambient environment it can provide. Technology Trajectories are groups of technologies in the information and communications sector, formed from the IST viewpoint.

Over 100 key technologies were discussed by experts and 10 were selected on the basis of the considerable impacts they would have on the information society: Bandwidth, Communications, Data Capturing, Human Interfacing, Info Visual Display, Info Retrieval, Pinpointing, Printing, Processing, and Storage. Section 4-3 below explains the future visions for these Technology Trajectories as analyzed by experts.

4-3 Technological trends

While FISTERA examines current trends (2004), trends toward 2010 and trends toward 2020 for the selected 10 Technology Trajectories, only their outlines are extracted from Reference 1 in this section.

(1) Bandwidth

In the next five years, xDSL at 100 Mbps with a loop length of 4 km and optical fibers will be laid. As a result, connections at speeds close to 100 Mbps will probably satisfy 99% of needs until beyond 2020[Note 1]. However, in the wireless and mobile communications environments, securing broadband will continue to be expensive until around 2010.

Research will continue into ways of providing broader bandwidth for specific purposes. With respect to broadband communications in areas such as holographic projection, Grid computing for scientific computations and medical and security applications, the needs are likely to go beyond general infrastructures and applications.

(2) Communications

Easy connectivity with network environments, or "the personalization of connectivity," will emerge in the next 10 years. With the advent of wireless routers and ad hoc networks by 2015, the interference problem will grow in relation to inter-terminal communications with a thousand times greater data rate. The report suggests that this perception should not be "taken for granted" and that an outlook on the direction of progress should be formed through further R&D.

(3) Data Capturing

This area, which has evolved continuously, is facing a major transition. Sensors will become less expensive and more easily available, just as monitoring from satellites, Web cameras and portable playback devices are today. Three-dimensional scanning may also be offered at low cost in the next 10 years. The technologies supporting such trends include electronics, bioelectronics, nanotechnology, MEMS, communications technology and chip manufacturing techniques that allow coexistence between analog and digital technologies.

The need for security in the information-processing environment can accelerate growth in this area. In the next decade, sensors will be embedded in most objects to form autonomous networks via a communication gateway. Broader applicability of sensors will enhance the validity of data, thus further increasing efforts to overcome challenges in information capturing.

(4) Human Interfacing

By the first half of the 2010s, human interfacing technologies that can adapt to personal feelings may emerge. In the latter half of the decade, "shadowing" (monitoring personal exchange of information daily) will become important, possibly evolving into a technology that would complement today's mechanical communications applications.

Communications are likely to depend more on "understanding" than on format. This will lead to issues such as who is responsible for any misinterpretation, which could delay technological progress. Artificial intelligence, interactive agents and other technologies are likely to become "tools" for overcoming such obstacles. While very interesting ideas have already emerged in several areas, they have yet to be solidified.

(5) Info Visual Display

Potential recognition of the significance of new developments in info visual display technology in such sectors as design, drugs and entertainment can bring about new market opportunities. In the next five years, displays in fixed and mobile environments are likely to improve in terms of resolution. Two-dimensional displays will advance over the next 15 years, but their margins will progressively shrink as they become commodities. New display technologies in the mobile environment will emerge to boost services and provide greater profits to those companies that control the advanced technologies. Three-dimensional displays will be confined to niche markets for the next five to eight years but will enable new services in the following decade. Although not inherently disruptive, 3D displays can become a disruptive technology that contributes to a mechanism for creating a new paradigm in the communications environment. Investment in this mechanism is more likely to produce wealth than investment in 3D technology.

(6) Info Retrieval

The quantity of data produced is increasing at extraordinary speed, and production is likely to double every 2 to 3 years over the next two decades. It should be noted that what really doubles is the "data" and not the information. Conversion of data into information and retrieval of that information will be the real technical challenges for the coming decade. Technological innovation regarding information retrieval will be essential for any type of information.

While expectations are high for technological developments in this area, predicting the details is not easy. A major milestone will be reached around 2008. Several fundamental developments will be achieved by this time, enabling more specific predictions. Finding solutions to the basic problems of information retrieval will lead to a critical change that can boost information society development in the future. At the same time, these solutions are likely to generate many challenges such as privacy concerns, intellectual property rights and information protection. In this technology area, improved benefits to citizens could also mean a higher risk of criminal activity.

(7) Pinpointing

By the end of 2010s, services that rely on smart tags, beacons, GPS and satellite-based positioning systems like Galileo will become so widespread that people will take their existence for granted and will no longer talk about them. By 2008, most products will have tags. In the following decade, "soft" products such as content will also be tagged. While concerns over security and privacy will remain high until around 2010, they will wane as new benefits that offset the shortcomings appear.

The information society will become a "tagged society," in which several technologies act in cooperation. From the IST perspective, the emergence of this tagged world is likely to create great opportunities for development in disciplines at the edge of ISTs, such as medicine and biology. It is already possible to tag proteins and viruses. By the end of the next decade, tracking tagged proteins will be much easier. This, in close synergy with ISTs in communications and other areas, will bring about a revolution in the healthcare sector.

(8) Printing

Printing has evolved so remarkably in technical terms as to completely revise business rules, although this fact is not widely recognized. This has opened the door to new services, thus changing business workflows and information exchange methods.

Looking as far ahead as 2015, a "disruptive" situation will arise from technologies that enable the printing function to be embedded in diverse objects and that make printing materials capable of self-printing (e.g. e-ink). Around 2010, printed matter will begin offering some sort of dynamic behavior. For example, printed matter that interacts with the user and automatically updates itself. By 2020, the standard meaning of "printing" will change from transferring a small amount of ink to paper to "reproducing an object."

Copyrights are likely to become physically integrated into printed matter, fundamentally changing users' relations with such materials. Conceivably, a single page of printed text may be able to interact with a user's personal area and negotiate reading rights before actually displaying its information.

(9) Processing

Over the past 30 years, processing power has doubled every 18 months, creating whole new industries and services. Reduced costs have expanded the market from a level of a few computers per country to more than one per household. Even now, in spite of a decrease in demand, the need for greater processing power continues. To meet this demand, it is necessary to reduce fixed costs, increase production and shrink sizes.

By 2020, every conceivable object is likely to have some sort of embedded processing capability. The question is whether industries will accept such an oligopolistic market as exists today if the above embedding becomes widespread, which translates into whether the companies dominating the processing devices field will continue to lead the market. Put another way, processing technology can evolve in either of two directions: toward providing equal opportunities for everyone (and every country) to develop products and services, or toward turning the market in favor of the dominant market players that control processing technology.

(10) Storage

With a new storage medium having been invented every five years and a disruptive innovation emerging every 10 years, storage capacity has doubled every year over the past decade, while storage price has decreased by 10% a year (currently, one euro buys around 300 GB). This trend is demonstrated in the evolution from floppy disks in the 1970s, through smaller diskettes in the 1980s and CD-ROMs in the 1990s, to DVDs in the 2000s. The potential of holographic disks is yet to be realized, while polymer memory is expected early in the next decade.

Such a disruptive technology cycle has had a profound impact on industry, from production through software, content production, information distribution and management to protection. Currently, there are no signs of slowdowns in capacity increase or in price reductions. Capacity is rapidly reaching a point where it can support local storage of huge quantities of information, creating a virtual local "Internet." This may also make everything recordable, enabling new services and creating completely new industries.

Ways of using storage are likely to change in order to enable household and other appliances to access, download and update/synchronize information via data communications infrastructures. By 2020, storage capacity to enable this will become available.

4-4 Technology disruptions

A new methodology or product can disrupt the existing market. When this kind of disruption is caused by technology, FISTERA calls it a "technology disruption." A typical example is seen in the relationship between PCs and mainframes. While their processing power was not as high as that of mainframes in the early days, PCs caused a technology disruption by providing the market with a different value.

The important issue in discussing a potential technology disruption is to analyze why it is assumed possible. Such analysis requires a deep understanding of technology. In other words, better outlooks and parameters worth discussing for R&D investment often derive from a deep understanding of technological trends.

Table 4 lists expected technology disruptions identified through FISTERA's discussion on Technology Trajectories.

Examples of technology disruptions are briefly explained below, based on the descriptions in

Table 4 : Expected technology disruptions as identified by FISTERA

Technology disruptions	From year
Transition from products to services	Already happening; main impact from 2010
Disappearance of the PC	2008-2010
Ubiquitous seamless connectivity	2008-2010
Changing traffic patterns	Already happening; major impact from 2010
Unlimited bandwidth	2015
Disposable products	2009
Autonomous systems	2007
From content to packaging	2010
Virtual infrastructures	2015

Source: Prepared by STFC based on Reference [2] the reference document. Experts predict the first disruption, "transition from products to services," as follows: Most appliances, including home appliances widely used in people's daily lives, will have connectivity with networks by 2008. In a broad sense, the functions of these appliances will be provided through software over the network. This implies that the current market, which adopts the model of providing values based on products, will be in transition to a service-based, value-provisioning model. This is what is meant by "transition from products to services."

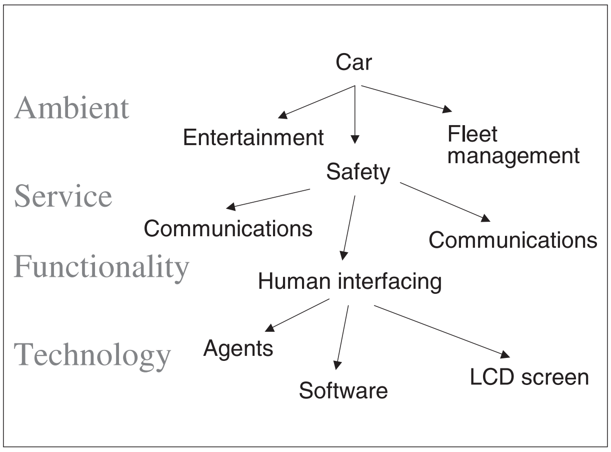
"From content to packaging," another technology disruption, suggests an attempt to offer meaningful information by retrieving from a large amount of data the combinations and display formats that are valuable to or favored by a specific individual. With production of content such as films and TV programs running at a tremendously high level, the value of each piece of content is steadily declining as oversupply continues. Thus, packaging, or effective presentation of content, is becoming important. The panel of experts draws attention to research into accumulation of personal information, which is conducted by Microsoft and other organizations. This is an example of research that sets out to explore what kind of packaging is valued by individuals.

4-5 Depicting technological trends in a layered structure

FISTERA uses clusters of technologies in the information and communications sector to predict trends in ISTs. The clusters for Technology Trajectories such as bandwidth, data capturing and human interfacing have been identified through the discussion on Technology Trajectories shown in Section 4-2 and adoption of the functionality viewpoint, i.e. what an information and communication technology can provide. Ten representative clusters have been described in the previous section.

How do these clusters interact with application areas as ISTs? What kind of relationship does a cluster have with its constituent technologies? FISTERA examines such relationships between technology and society using a four-layer structure: Ambient, Service, Functionality and Technology. The bottom layer, Technology, consists of 3D scanner, batteries and many other technologies as shown in Table 3. Sitting above this is Functionality, or what a technology does, and then Service, or what a function provides. The top layer is Ambient.

Figure 1 : An example of Technology Trajectory

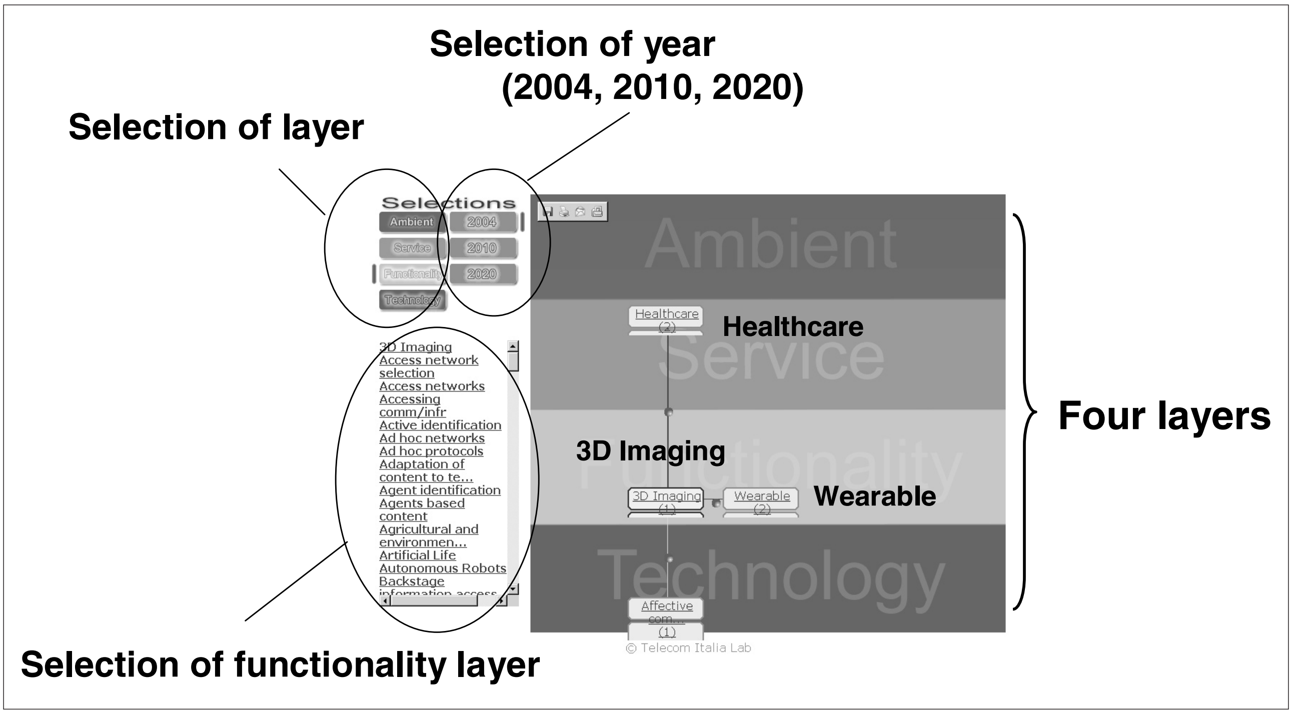


Source: Prepared by STFC based on Reference [1]

We can use the car as an example of Ambient to better explain the relationships between the layers. Figure 1 shows how the car is perceived under the Technology Trajectory concept, or how the given Ambient can be broken down into the underlying layers of Service, Functionality and Technology. The car provides services such as entertainment and fleet management. "Safety" is also a service. The functionalities supporting safety are communications, voice recognition, advanced human interfacing and so forth. These functionalities are enabled by technologies such as agents, software and LCD screens. Although this example is explained using a top-down approach, a reverse approach is also possible. The advancement of a particular technology can be examined from the IST viewpoint using a bottom-up approach - first examining what kind of functionality it is likely to offer in the future, and then, what kind of service it could enable. In FISTERA, experts investigated trends in Technology Trajectory clusters using this layered structure.

Figure 2 shows a Web page depicting a Technology Trajectory cluster, which can be accessed at http://fistera.telecomitalialab.com/. This page visualizes scenarios for 2004,

Figure 2 : Graphical depiction of Technology Trajectories



Source: Prepared by STFC based on Reference [5]

2010, and 2020. The screenshot in Figure 2 indicates that when "2004" and "3D Imaging" are selected as the year and the functionality, "Wearable" (functionality) and "Healthcare" (service) are displayed as areas to which the given functionality contributes. This means that, as of 2004, 3D imaging technology is already boosting technological advances in medical diagnosis, while measuring health conditions through wearable technologies has enabled remote monitoring, contributing to health management.

5 Conclusion

FISTERA can be characterized by two major points. The first and most interesting is that the entire study was designed as part of a process aimed at achievement of a particular agenda. That is, the FISTERA project was designed purely for the purpose of fulfilling the Lisbon Objective by 2010. Thus, the results of its studies and analyses clearly indicate the impact on this goal.

The second point is that multiple perspectives were adopted in performing foresight studies and analyses throughout the three-year project term. Each phase of the project was made widely accessible to the public so that feedback could be used in the next-phase discussions of the working groups. This process was facilitated by using the Internet. Moreover, during foresight studies, the participating experts were provided with a range of basic data such as demographics and other socio-economic indicators. These approaches undoubtedly helped to deepen awareness of the goal among the experts, building a better and more solution-oriented consensus.

FISTERA only targets European ISTs, but there are many things Japan can learn from the project regarding research aimed at formulating national science and technology policies.

Note

1: The discussion here refers to transmission capacity at access level, not that in backbone networks.

References

[1] Key Factors Driving the Future Information Society in the European Research Area, Synthesis Report on the FISTERA Thematic Network Study (September 2002-September 2004)

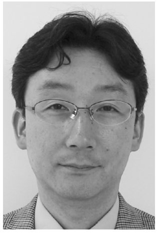
[2] Dachsl, Bernhard; Weber, Matthias; Zahradnik, Georg. Europe's strengths and weaknesses in Information Society Technologies, a patent analysis. January 2005

[3] "Human Resources in IST: Challenges and Opportunities for Europe - Results of a FISTERA Workshop, Seville, 14-15 June 2004, July 2004"

[4] PREST, The University of Manchester, U.K. The FISTERA DELPHI, Future Challenges, Applications & Priorities for Socially Beneficial Information Society Technologies.

[5] Web site of FISTERA: http://fistera.jrc.es/

[6] Informative Web site on Technology Trajectories: http://fistera.telecomitalialab.com/



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